MARMONI activities and results in brief

Innovative approaches for marine biodiversity monitoring and assessment of conservation status of nature values in the Baltic Sea

01.10.2010 - 31.03.2015

MAR MONI

MARMONI activities and results in brief
LIFE+ Nature & Biodiversity project MARMONI "Innovative approaches for marine biodiversity monitoring and assessment of conservation status of nature values in the Baltic Sea" (LIFE09 NAT/LV/000238). The content of this publication is the sole responsibility of the authors and it can in no way be taken to reflect the views of the European Union.

Prepared with a contribution from the LIFE financial instrument of the European Community, Latvian Environmental Protection Fund and Estonian Environmental Investment Centre.

This publication is dedicated to the memory of Andres Kuresoo, Estonian University of Life Sciences, one of the leading seabird specialists in the Baltic Sea Region, co-author of the MARMONI seabird indicators and long-years cooperation partner for the Baltic Environmental Forum in its marine projects. Andres Kuresoo passed away suddenly in September 2014. He is living further in his family, friends and colleagues, in his students and his publications – in this one as well.

Publisher:
Baltic Environmental Forum Latvia (BEF Latvia), 2015
Antonijas 3-8, Riga, LV-1050, Latvia
Tel. +371 6735 7555
www.bef.lv

Text author: Heidrun Fammler, MARMONI project manager
with input from:
Nicklas Wijkmark – AquaBiota Water Research (Sweden)
Antti Lappalainen – Finnish Game and Fisheries Research Institute
Heidi Hällfors – Finnish Environment Institute
Georg Martin – Estonian Marine Institute, University of Tartu (EMI)
Ainars Aunins – Latvian Fund for Nature
Leif Nilsson – Lund University (Sweden)
Edgars Bojārs, Kristīna Veidemane, Anda Ruskule – Baltic Environmental Forum Latvia

Designer: Lolita Piterniece, "Max Mor"
Language editing: Holger Jänes, EMI
Cover photo: ©Metsähallitus 2011
Printed by: Talsu tipogrāfija
Printed on 100% recycled paper Cyclus offset

The Baltic Sea – a fragile ecosystem vis-à-vis growing maritime economy

The Baltic Sea is a particularly fragile ecosystem having many characteristic features not found anywhere else in the world. The high ecological complexity in the Baltic Sea is mainly caused by simultaneous influence of multiple ecological gradients (salinity, climate, exposure, geology, geomorphology etc.). This results in uniqueness of the ecological features in almost all locations in the Baltic Sea. Habitat degradation as well as modification in any particular location in the Baltic Sea may have a fatal impact on its biological diversity.

"Europe's future depends on growth and jobs, and much of this growth and jobs will come from maritime economy. Ocean use and exploration has moved from traditional fisheries and shipping sectors to innovative uses ranging from fossil and mineral resources via renewable energy to seabed mining and blue biotech. Ensuring long-term sustainability of the marine resources is a major challenge as well as a major opportunity for development, because already now the marine environment is being affected by multiple human pressures as well as climate change impacting the foundations of our ecosystem." (H. Siemers, European Commission, 17 June 2014)

If we want to protect the Baltic Sea's fragile ecosystem and keep economic growth within sustainable limits, we need to know more about the marine nature; if we want to monitor and assess changes in the ecosystem or pressures from economic activities in the sea and at coastal areas, we first need to describe the state of marine biodiversity. The northern Baltic Sea monitoring programmes so far have focussed on monitoring the major pressures to the sea (eutrophication and pollution from hazardous substances), not on biodiversity itself.

Monitoring the state of marine biodiversity was the main issue which the LIFE MARMONI project, implemented from October 2010 till March 2015, aimed to contribute to - by developing indicators, methods and tools for monitoring and assessment of marine biodiversity, conservation status of species and habitats.

The project has been implemented in four countries - Latvia, Estonia, Finland and Sweden. In the following text, the main activities, results and learnings have been described in brief. More detailed information and publications can be accessed on the MARMONI project's website http://marmoni.balticseaportal.net/.

Riga, January 2015
Heidrun Fammler

Photo: Nicklas Wijkmark, AquaBiota Water Research, Sweden

Why did we propose the project? The European policy context and MARMONI

When writing the MARMONI proposal in 2009 the Marine Strategy Framework Directive (MSFD) was just approved and its implementation challenges were far ahead; EU Member States were struggling with designation of Marine Protected Areas in their territorial waters and off-shore. The new Directive aimed to achieve the so-called "Good Environmental Status" (GES) of all EU's marine waters by 2020, a principle well-known since 2000 from the Water Framework Directive's (WFD) approach, which aims at achieving good ecological and chemical status for all waters, including coastal waters, of the Member States by 2015. The MSFD became the umbrella instrument for all other environmental legislation covering off-shore marine areas. It demands an ecosystem based approach to managing human impact on the marine environment, integrates the concepts of environmental protection and sustainable use, strives for a regional approach and encourages cooperation, essentially between neighbouring countries.


Photo: Heiko Kruusi

One of the major challenges for implementation of the explicit objective of the MSFD ("biodiversity is maintained by 2020") is the lack of a common understanding on the state of biodiversity and its assessment and monitoring methods used by different countries. The Initial Assessment (1st step in MSFD implementation) of the marine waters, performed in 2012, showed that each EU Member State is using its own assessment methods. For example, the herring stocks in Estonia are evaluated based on different ecological indicators than in its direct neighbouring countries Finland or Latvia, despite sharing the same fish stock and the ecosystem.

Therefore, developing commonly agreed criteria for monitoring and assessing marine biodiversity has been acknowledged as a highly important topic on the agenda of the European Commission in recent years. Also at Regional Sea's Convention level, in particular at the Baltic Sea Region with its long tradition of cooperation within the Baltic Sea Action Plan (HELCOM), marine monitoring based on commonly agreed indicators has been worked on actively: the CORESET project (2011–2014) was supposed to design a list of indicators to be used by all contracting parties in their future monitoring programmes.

MARMONI aimed at playing a front runners' role in developing, discussing, testing, assessing and recommending a set of indicators and relevant monitoring methods in a certain regional context with the clear aim to promote its results in the Baltic Sea region and beyond. MARMONI wanted to feed into these processes with the work of its multinational team of outstanding experts from well-known institutions ready to contribute to the marine biodiversity indicator development task and ready to share their knowledge and lessons learned with a wider audience.

MARMONI has been funded by the EU LIFE programme's biodiversity strand under a specific objective of the 2009 call in which the LIFE programme has been taking up the implementation challenges of the MSFD: to contribute to the development of indicator based marine biodiversity monitoring. The funding has been generous: 5.9M€ over a period of 4.5 years facilitated the reaching of excellent results.

MARMONI complexity. What did we do and what did we achieve?

The **main aim of MARMONI** was to develop innovative and ecosystem-based monitoring and assessment approaches based on a set of indicators for assessment of conservation status of marine biodiversity and related impacts of human activities. These assessment approaches were supposed to be integrated into national (Estonian, Latvian, Finnish and Swedish) marine biodiversity monitoring programmes. With its work MARMONI was aiming to contribute to the implementation of the MSFD as well as the Birds and Habitats Directives and the HELCOM Baltic Sea Acton Plan with regard to the assessment and monitoring of the state of marine biodiversity. Partly, the indicators may also contribute to the implementation of the WFD.

MARMONI has achieved results on the following issues:

- Developing a set of "true" marine biodiversity indicators;
- Testing the indicators and survey methods in the field (four demonstration areas) and proposing a few for wider application e.g. at Baltic Sea level;
- Assessing cost and time effectiveness of these methods and attempting to determine the costs of indicator monitoring versus completeness of the gathered information;
- Applying the indicators for biodiversity assessment according to Good Environmental Status (GES) of the MSFD as well as Favourable Conservation Status (FCS) of species and habitats according to the Habitats Directive;
- Demonstrating marine spatial management in Sweden to apply the indicators and survey methods at spatial dimension and make it applicable at planning processes;
- Accompanying and impacting the implementation of the MSFD in the four target countries and contributing to indicator based marine biodiversity assessment and monitoring at the Baltic Sea scale;
- Providing recommendations and forwarding lessons learned on indicator development, assessment of marine biodiversity and future marine monitoring programmes to competent authorities and policy makers;
- Informing stakeholders on marine biodiversity and its regulating policy frame as well as involving them in monitoring and supervision activities;
- Promoting MARMONI results at international conferences and seminars;
- Providing scientific backstopping for future monitoring methods and indicators by preparation and submission of a series of articles to scientific journals and preparing comprehensive publications under the MARMONI logo.

Taking benthos samples by diving

Training on radar studies of migrating birds in April 2013 in Matsalu National Park, Estonia

The MARMONI marine biodiversity indicators and their development process

MARMONI has analysed existing marine monitoring programmes and indicators in relation to marine biodiversity. It was found that most of the programmes were designed for the assessment of the effects of eutrophication or hazardous substances, although some components of marine biodiversity were included to describe and follow the impacts of the pressures. MARMONI, therefore, focussed on development of new "true biodiversity indicators" reflecting the state of a certain component of marine biodiversity.

In four and a half years, the MARMONI project developed and tested 49 marine biodiversity indicators covering four thematic groups – fish, birds, as well as benthic and pelagic communities. Most of these indicators have already proven to be operational in the tested area(s) and only 5 still need to be developed further. The indicators are published in a two-volume report called "*The MARMONI approach to marine biodiversity indicators"* (ISBN 978-9985-4-0873-5) and several scientific articles - also available on the project web site at http://marmoni.balticseaportal.net/wp/category/biodiversity-indicators.

The MARMONI team was not aiming at developing a complete list of indicators covering all possible aspects of marine biodiversity and all assessment needs set by different policy instruments. Instead, the aim was to fill the knowledge gaps in indicators reflecting the state of marine biodiversity and to propose new innovative approaches to increase the cost-effectiveness of monitoring and assessment of marine biodiversity and in this way support modernization of national marine monitoring programmes.

The indicator development, as all project related work, was taking place in four MARMONI demonstration areas: Irbe Strait and the Gulf of Riga (shared by Latvia and Estonia), Hanö Bight (Sweden), Coastal Area of South West Finland, and the Gulf of Finland (Finland and Estonia). Most of the indicators were developed for one of the project areas, except a few bird indicators, which were developed for the entire Baltic Sea due to high mobility of the species. Some of the indicators were later tested in one or several other project area(s). However, despite the limited geographical range of the demonstration areas, most of the indicators are applicable on a wider geographic scale and in different environmental settings.

On the next pages, four examples of indicators, representing the four thematic groups of the MARMONI work (fish, birds, benthic and pelagic communities), are illustrated.

Photo: Leho Luigujõe, Estonian University of Life Sciences

A colony of Great Cormorants *Phalacrocorax carbo*

Examples of our indicator work: selected indicators

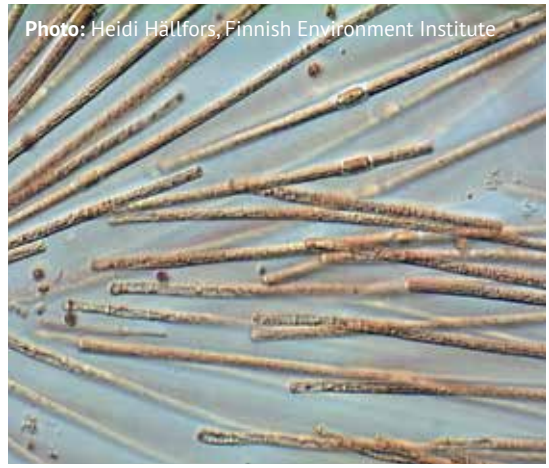
1st example: the pelagic indicator Phytoplankton taxonomic diversity (Shannon95)

The phytoplankton community is the key primary producer in the marine ecosystem. The higher the biodiversity of phytoplankton is, the more resistant the community is to changes caused by pressures in its environment. A species-rich community consists of various different features that are needed to maintain ecosystem functioning. Eutrophication is the most important factor causing degradation of the Baltic Sea ecosystem. The sensitivity of phytoplankton diversity to eutrophication has been demonstrated both in the Baltic Sea and elsewhere. Therefore, it is important to monitor phytoplankton biodiversity in relation to eutrophication.

The indicator reflects the diversity of the summertime phytoplankton community by describing to what extent it is dominated by just one or few taxa. It is well known that the biodiversity of phytoplankton is difficult to determine. However, this indicator utilizes a novel and robust approach, the Shannon95 metric, for detecting changes in diversity. This calculation method circumvents these problems by using the main body of the phytoplankton community (i.e., the taxa that cumulatively constitute 95% of total biomass) to compute the indicator, thus being less sensitive to variation caused by the random presence of sparsely occurring species.

The photosynthetic ciliate *Mesodinium rubrum*

The dinoflagellate *Dinophysis rotundata*



The cyanophyte *Aphanizomenon flos-aquae*

2nd example: the fish indicator
The length at sexual maturation of female pikeperch (*Sander lucioperca*) in monitoring catches

In the Baltic Sea, pikeperch is an important fish for both commercial and recreational fisheries in coastal areas. A strong fishing pressure may lead to a decrease in number of larger individuals who usually occupy higher trophic level, which in turn may lead to a decline in overall local biodiversity.

However, the data available for pikeperch usually do not allow proper stock assessments to be carried out. Thus, there is a need for alternative and less data demanding approaches and indicators.

For this purpose, data on three of the best-studied coastal pikeperch stocks in Estonia and Finland were combined. A connection was found between intense selective fishing and the decreased length at maturity (TL50 - length at which 50% of fish have reached maturity) of female pikeperch, indicating that overfishing has caused long-term changes in the coastal pikeperch stocks.

According to simulation-based power analysis, less than 70 samples (females) per year produce reasonable and almost maximal precision when determining the six-year mean TL50 for a stock. Thus, TL50 could be used as a cost-efficient indicator of the effects of fisheries on coastal pikeperch stocks, both for MSFD purposes and for local fisheries management.

A 43-cm-long pikeperch caught in the Archipelago Sea. In this intensively fished area, the present TL50 for female pikeperch is around 30 cm. In the less intensively fished Helsinki region in the Gulf of Finland, the TL50 value is around 35 cm

3rd example: the bird indicator
Wintering waterbird index

The Baltic Sea is a wintering area for millions of waterbirds of different species. Waterbirds are top predators in marine ecosystems and therefore well suited to function as indicators of the environmental status of marine environment. They are also easier to survey than most other organisms in the sea.


Photo: Ainārs Auniņš, Latvian Fund for Nature

A flock of Velvet Scoters *Melanitta fusca* in flight

The indicator is based on annual counts on a network of sites along the coasts undertaken by volunteers in mid-January. These counts cover the inshore areas, but there are important numbers of certain species in the offshore waters that require special surveys (from the air). Long term data from the International Waterfowl Counts in the MARMONI study areas in Estonia, Latvia and Sweden have been used and later applied to the entire Baltic Sea.

Based on the counts, annual indices are calculated for different species by a standardized method. The count results are normalized by setting the mean for a time period = 1. A common wintering bird indicator is calculated as the geometric mean of the relevant species indices. Indicators can also be presented for the separate species or functional groups (e.g. benthic feeders, herbivores, fish eaters). In the latter case geometric means of the species indices for the separate groups are used.

At present, there are not enough data for including the offshore areas, but corresponding survey methods were tested within MARMONI which enable to include offshore areas in the calculation of the indicator in coming years.


Photo: Ainārs Auniņš, Latvian Fund for Nature

A flock of Goosanders *Mergus merganser*, Mallards *Anas platyrhynchos* and a Tufted Duck *Aythya fuligula* resting

4th example: the benthic indicator Spectral variability index (SVI)

The spectral variability index quantifies the variability in a remotely sensed (air-borne or space-borne) imagery that, in turn, indicates the benthic biodiversity (see figure 1 below).

The method is potentially useful in extensive shallow water areas that are difficult to reach with a vessel. High resolution remotely sensed multi- or hyperspectral imagery that reflects seabed properties is needed to calculate SVI, i.e. the method can be used only in shallow and very clear waters.

The spectral centroid of each cell of a predefined grid is calculated as the mean value of each band or principal component of the imagery. The distance of each pixel from the spectral centroid is then determined within each cell. The mean distance of all pixels from the spectral centroid in a given cell is considered as the spectral variability of that cell. The mean value of spectral variability over all cells in an assessment unit serves as the value of SVI (see figure 2 below).

For the purposes of biodiversity monitoring, the method is suitable for trend analysis based on a time-series of hyperspectral imagery.

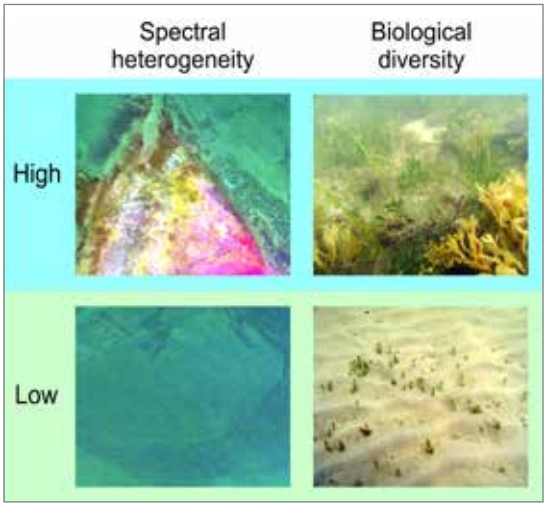


Figure 1. Conceptual illustration of the relationship between remotely sensed heterogeneity and biological diversity.

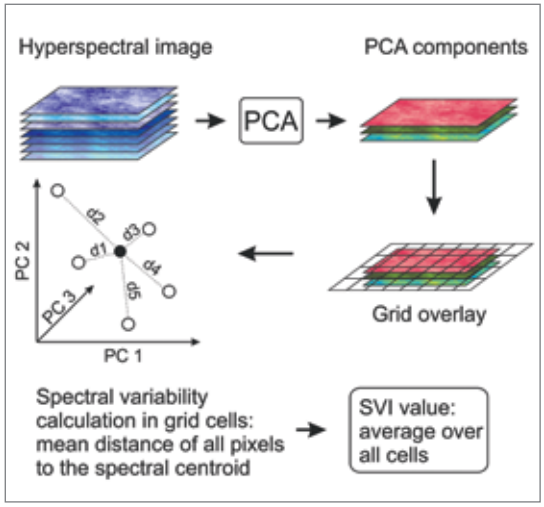


Figure 2. Flowchart of the calculation of SVI.

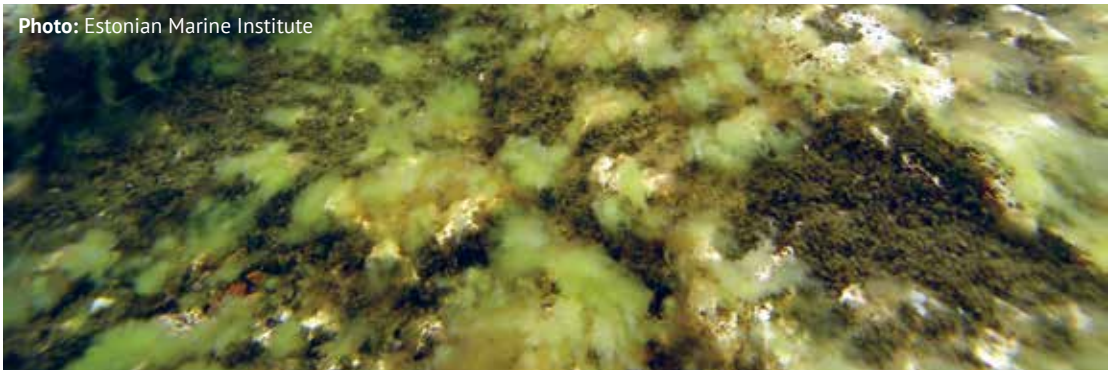
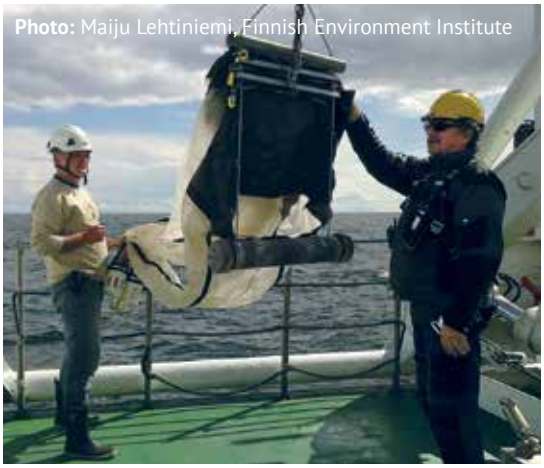


Photo: Estonian Marine Institute

Indicator and survey method testing and cost effectiveness assessment

MARMONI has tested in three years' field seasons the proposed integrated assessment technique and biodiversity indicators as well as special methods and equipment for monitoring. All in all, 17 new, partially new, or modified existing monitoring methods were tested. Most (15) were methods for monitoring of benthos and plankton, and two for bird monitoring. In addition to those, several conventional monitoring methods were utilised to collect data needed for indicator development and testing. The methods were tested in the four project study areas. The full survey report can be found on the project web site at http://marmoni.balticseaportal.net/wp/project-outcomes.



Sampling onboard rv Aranda

Another goal for testing was to find out options for data collection in a more **time- and cost-effective way** compared to conventional methods; this also includes checking for a better spatial or temporal coverage and/or level of detail. The main challenge in developing those methods is to maintain a high quality and sufficient detail of the attained data. Many reliable conventional methods have been developed for collection of highly detailed information from each surveyed station – but these methods are often time-consuming and laborious, which strongly limits the number of samples and affects the spatial and temporal coverage.

One idea is to choose methods that provide data for more than one indicator or combinations of several methods during the same survey from the same vessel in order to save costs for vehicles. However, this is limited due to the very different working methods (e.g. for bird counts, fishing and benthic habitat mapping) and this option shall be evaluated in each individual case.

In order to decrease the costs of (traditional and new) monitoring activities, several new methods are automated alternatives to manual methods where parts of the processes are performed by machines or algorithms. Thus, the number of working hours performed by experts will be reduced. Automated methods also can decrease subjectivity and eliminate biases caused by differences in expert knowledge. Methods for the automatic identification or measurements of benthic fauna, phytoplankton, zooplankton and birds were tested in MARMONI and evaluated to be applicable. However, many of these novel methods require further development to be fully operational, and some manual labour is still needed. In the most cases the new automated methods will always need to be used in combination with conventional methods to verify and calibrate the automatic methods. MARMONI experts consider it unrealistic that biodiversity monitoring methods will ever be fully automated.

It can be concluded that since the aims and techniques of the tested methods in MARMONI varied notably, the testing strategies differed among methods. Some methods were shown to function well in a technical and practical aspect, but failed to fulfil the requirement of cost-effectiveness, while others were rejected due to technical or practical issues. However, the majority successfully passed the evaluation and should be considered as functional and (cost) effective monitoring methods, or potentially effective methods that need some further development in order to be fully operative.

Biodiversity assessment

The MARMONI indicator work also included an exercise to assess the marine biodiversity and test the applicability of the developed indicators. The project team developed and tested a web based application **"MARMONI Biodiversity Assessment Tool"** with the aim to ease biodiversity assessment for authorities and policy makers. It is available online and ready to be used www.sea.ee/marmoni/index.php.

This indicator-based integrated assessment was performed at the final stage of the project and showed potential obstacles and drawbacks of the indicators - mainly related to data quality and availability, but also to the structure and character of the indicators themselves. The main lessons learned are that a higher number of indicators provide more robust assessment results with a higher confidence and certainty level; systematic data collection should be carried out in the assessment area in order to fulfil all requirements of the indicators; different indicators do have different operational geographical scales; and, further development of biodiversity indicators is necessary in order to gain better coverage and representation of all required biodiversity characteristics and elements.

Assessment of the conservation status of species of Community importance: example of the Common Shellduck

Favourable Conservation Status (FCS) assessment

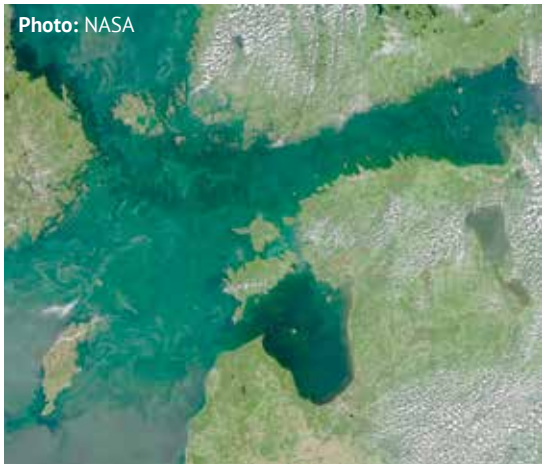
Additionally, an assessment of the conservation status of species and habitats of Community importance was carried out by the MARMONI project team following the assessment procedure described by the EU Habitats Directive. According to the Habitats Directive, the conservation status assessment has to be carried out nationally by the EU Member States and then supra-nationally at EU level. MARMONI carried out the FCS assessment at a finer – the MARMONI project area - scale. The FCS assessment was carried out for each marine species and habitat, on which the relevant country is obliged to report under the Birds and Habitats Directives. The results are summarised in 83 fact sheets giving proportions of favourable, inadequate, bad or unknown conservation status in each of the assessment categories (distribution, population size or habitat area, habitat for species, structures and functions). The assessment is available on the MARMONI web site at http://marmoni.balticseaportal.net/wp/project-outcomes.

Demonstration of Marine Spatial Management in Sweden

The Swedish MARMONI team focused on the spatial dimension at its demonstration area Hanö Bight using spatial modelling to demonstrate marine management to county administrations. The modelling resulted in over 70 full scale species distribution maps, which are freely available. A series of ocean zoning tools for marine spatial planning were reviewed, and a full scale spatial management demonstration was performed in Hanö Bight. A spatial ecosystem model was developed; furthermore, conservation values were modelled and scenarios of effects on the ecosystem due to wind park construction and eutrophication (a decreased water transparency) were developed. These demonstrations provide excellent examples for (regional) planning authorities how to integrate the ecosystem approach into planning and consider optimum locations for economic activities and prioritise conservation actions for valuable habitats and species.

Policy impacts of MARMONI on national and regional monitoring programmes

All in all, MARMONI has significantly contributed to supporting the implementation of the MSFD with regard to establishment of optimised biodiversity monitoring programmes in the project target countries and an overall improvement of the assessment capacity of the state of marine biodiversity in the Baltic Sea. In particular, the knowledge gained through indicator development, field works, modelling and data analysis about the status and distribution of species and habitats will help the state authorities to define appropriate management plans for particular areas, to assess their conservation status as well as their contribution to the state of biodiversity of the Baltic Sea.



MODIS sattellite image of algal bloom in the NE Baltic Sea

MARMONI has had a direct impact on regional marine biodiversity monitoring programme development due to its input to the HELCOM CORESET indicator project and the HELCOM MORE project aiming at harmonising marine monitoring at the Baltic Sea Region level. Consequently, MARMONI will also aid the national monitoring programme developments as they are being currently refined in line with the HELCOM proposals and MSFD implementation. Already more than half of MARMONI indicators have been included in the monitoring programmes of one or more of the project countries and close to same amount are recommended for consideration in future.

MARMONI experts have influenced discussions and decisions at HELCOM MORE and CORESET projects bringing in the systemic approach for indicator development and biodiversity focus of MARMONI. The collaboration between MARMONI and the HELCOM CORESET projects has resulted in direct input to the list of CORESET indicators as well as in indirect impacts throughout the course of the Baltic Sea wide indicator development, e.g. sharing of learned lessons from the results of indicator testing as well as applied methods and interpretation. The CORESET project has partly taken up the indicators developed by MARMONI, assessed their applicability at all 10 HELCOM contracting parties and modified them, if necessary, to suit as the Baltic Sea wide indicators. As a result, six MARMONI bird indicators, one fish indicator and one pelagic indicator have contributed to development of the relevant "core" indicators of the CORESET list, while two benthic indicators are currently included in the "pre-core list". Furthermore two pelagic indicators are proposed as candidate indicators to CORESET and one - to HELCOM EUTRO-OPER.

One of the key findings derived from the MARMONI project is that all Member States (and international organisations) are striving for "cost-effective marine monitoring" - and this shall not be confused with "low costs for biodiversity monitoring" or "less amount of parameters monitored and/or experts needed due to better technologies/equipment". The MARMONI work has clearly revealed that for proper assessment of the state of marine biodiversity a considerable amount of indicators, data and expertise is needed, otherwise the results will not be sufficiently reliable and robust. Innovative methods and harmonised approaches in field surveys and assessment, especially among countries sharing a regional sea basin, can contribute to cost effective data collection, but the political will to reach harmonisation and inter-calibration is still lacking due to "long years' traditions" in marine monitoring.

The larger network of MARMONI

Stakeholder information on new EU maritime policy

MARMONI wanted to inform stakeholders in the four target countries (and beyond) about the new EU marine and maritime policy and demonstrate its interlink with the existing legal framework. In the frame of the project, five international seminars have been held on various issues: the MSFD and its interlink to existing environmental legislation; marine biodiversity indicators; innovative approaches to marine biodiversity monitoring and assessment; new developments with regard to off-shore wind parks and environmental impact studies; maritime spatial planning and its interlink to the MSFD. More than 250 participants were present at these events and actively discussed policies and their implementation experience.

Besides, MARMONI also actively promoted its work and findings at events related to marine and maritime issues in Estonia, Latvia, Finland and Sweden and participated in or organised more than 50 workshops, info days and conferences with the goal in mind to facilitate stakeholders' involvement in marine biodiversity monitoring, data and information sharing and integration of marine biodiversity aspects into sectorial policies such as fisheries, maritime affairs and ocean energy.

Promotion of MARMONI work and results

MARMONI experts have presented their work and results at a series of international conferences and other events in the Baltic Sea region, all over Europe and even in the USA, Australia and China. Altogether, MARMONI experts have participated in 23 events in 16 countries. The issues presented in oral presentations and posters were mostly the single indicators, the assessment tools and methods, as well as the MARMONI approach to biodiversity monitoring seeking for the "true biodiversity indicators". The project has gained considerable international recognition and received a large amount of invitations to present itself at events.


Photo: From the private archive of Ainārs Auniņš

MARMONI has also tried to bring its complicated subject ("monitoring of marine biodiversity based on true biodiversity indicators") to the wider public by participating in Maritime Days in the project countries and Baltic Sea region and by posters and flyers distributed to people at different occasions. The ferry line *Tallink* became sponsor and cooperation partner 3 years ago. Each year eight of its ferries, which operate between Estonia, Finland, Sweden and Latvia, accommodate a set of posters on various issues (marine nature values, monitoring methods, species, and biodiversity indicators).

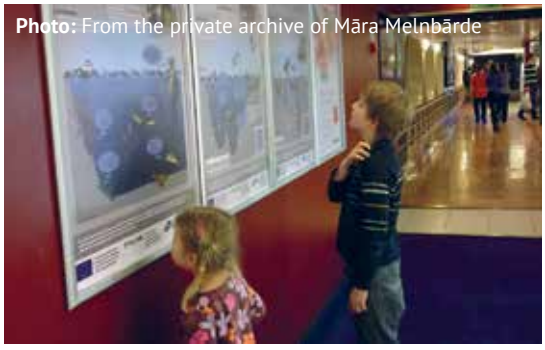


Photo: From the private archive of Māra Melnbārde

Scientific backstopping

MARMONI was a project targeted at implementing European environmental policy, not a research initiative. However, the key experts were scientists from various research institutions for a good reason. Biodiversity monitoring and survey methods need to be investigated and tested based on high quality standard methods and in accredited laboratories. Furthermore, to be used and quoted later on, these methods and indicators need a scientific basis which usually is a publication. Therefore emphasis has been put on elaboration of a series of scientific articles and manuscripts (to date 4 articles have been published, 8 submitted and 10 under preparation) to backstop MARMONI work and give it authorisation for being formally accepted methods and techniques that can be used by monitoring institutions.

MARMONI FACTS & FIGURES

- Full project name: "Innovative approaches for marine biodiversity monitoring and assessment of conservation status of nature values in the Baltic Sea"
- Funding: EC LIFE Nature & Biodiversity Programme
- Total budget: 5.9 million €
- Implementation time: October 2010 - March 2015
- 11 project partner institutions and 6 sub-contractors
- 4 countries: Latvia, Estonia, Finland and Sweden
- 70 persons contributed to project success
- Competent authorities in charge of marine biodiversity assessment, monitoring and policy from the four countries and international organisations actively involved
- Number of actions: 18
- 28 existing marine environmental indicators analysed and 48 indicators proposed as operational
- 11 new monitoring methods proposed for future use
- 153 spatial maps prepared
- A tool for biodiversity assessment proposed to HELCOM for use in the Baltic Sea holistic assessment
- 4 publications for stakeholders and policy makers elaborated
- More than 20 scientific articles published, submitted, or in preparation
- More than 50 events for different target groups organised
- Project experts participated and presented MARMONI in 23 international conferences
- Notice boards erected at 9 terrestrial locations in the project countries
- 4 series of different info posters toured on 8 ships of the TALLINK ferry line for 4 years, potentially seen by 180 000 ferry passengers.

For more information please visit the project website:

http://marmoni.balticseaportal.net

The project's consortium: partners and sub-contractors

Latvia
Baltic Environmental Forum Latvia (BEF LV) (project lead)
Latvian Institute of Aquatic Ecology (LIAE)
Institute for Environmental Solutions (IES)
Latvian Fund for Nature (LFN)
Nature Conservation Agency (NCA)
Latvian Ornithological Society (LOB)

Estonia
Baltic Environmental Forum Estonia (BEF EE)
Estonian Marine Institute, University of Tartu (EMI)
Estonian University of Life Sciences (EMU)

Finland
Finnish Environment Institute (SYKE)
Finnish Game and Fisheries Research Institute (FGFRI)

Sweden
Swedish Environmental Protection Agency (SEPA)
Swedish Agency for Marine and Water Management (HAV)
AquaBiota Water Research
Lund University, Department of Biology
The County Administrative Board of Blekinge
The County Administrative Board of Skåne

Co-financers:
Environmental Investment Centre (Estonia)
The Ministry of Environmental Protection and Regional Development (Latvia)
through the Latvian Environmental Protection Fund Administration (Latvia)

Life

ENVIRONMENTAL INVESTMENT CENTRE

L V A F Latvijas vides aizsardzības fonds